

CLAIMS

1. Solid oxide fuel cell including a cathode, an anode and at least an electrolyte membrane disposed between said anode and said cathode, wherein said anode comprises a ceramic containing at least one of cobalt and iron, said ceramic being mixed with doped ceria.
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2. Solid oxide fuel cell according to claim 1 wherein the ceramic is a perovskite structure or a perovskite-related structure.
3. Solid oxide fuel cell according to claim 1 wherein the ceramic contains cobalt and iron.
- 10 4. Solid oxide fuel cell according to claim 1 wherein the ceramic has a formula $M_{2-x}Sr_xFe_{2-y}Co_yO_{5\pm\delta}$ wherein M is Ca or a rare earth element; x and y are independently equal to a value comprised between 0 and 2, extremes included, and δ is from stoichiometry
5. Solid oxide fuel cell according to claim 1 wherein the ceramic has a
15 formula $M_xSr_{1-x}Fe_{1.5-y}Co_yO_{3+\delta}$ wherein M is Ca or a rare earth element; wherein x and y are independently equal to a value comprised between 0 and 0.7, extremes included, and δ is from stoichiometry.
6. Solid oxide fuel cell according to claim 5 wherein the ceramic is $La_{0.8}Sr_{0.2}FeO_3$.
- 20 7. Solid oxide fuel cell according to claim 1 wherein the ceramic is a lanthanum strontium cobalt iron oxide.
8. Solid oxide fuel cell according to claim 7 wherein the lanthanum strontium cobalt iron oxide has a general formula $La_{1-x}Sr_xCo_{1-y}Fe_yO_{3-\delta}$, wherein x and y are independently equal to a value comprised between 0
25 and 1, extremes included and δ is from stoichiometry.
9. Solid oxide fuel cell according to claim 8 wherein a lanthanum strontium cobalt iron oxide has a formula $La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\delta}$.
10. Solid oxide fuel cell according to claim 1 wherein the anode is metal-free.
- 30 11. Solid oxide fuel cell according to claim 1 wherein the ceramic is mixed with the doped ceria in a ceramic/doped ceria ratio ranging from 50:50 to 95:5.

12. Solid oxide fuel cell according to claim 11 wherein the ratio ranges from 60:40 to 80:20.

13. Solid oxide fuel cell according to claim 1 wherein the doped ceria is selected from gadolinia-doped ceria and samaria-doped ceria.

5 14. Solid oxide fuel cell according to claim 1 wherein ceria is doped with a cation selected from lanthanum, ytterbium, yttrium, calcium, terbium, neodymium or dysprosium.

15. Solid oxide fuel cell according to claim 1 wherein the doped ceria is doped in an amount of about 20% by mole.

10 16. Solid oxide fuel cell according to claim 1 wherein the doped ceria $\text{Ce}_{0.8}\text{Gd}_{0.2}\text{O}_{1.90}$.

17. Solid oxide fuel cell according to claim 1 wherein the doped ceria has a submicronic particle size.

15 18. Solid oxide fuel cell according to claim 17 wherein the doped ceria has a particle size is lower than 100 nm.

19. Solid oxide fuel cell according to claim 1 wherein the cathode comprises a ceramic selected from the group consisting of

20 - $\text{La}_{1-x}\text{Sr}_x\text{MnO}_{3-\delta}$, wherein x and y are independently equal to a value comprised between 0 and 1, extremes included and δ is from stoichiometry; and

- $\text{La}_{1-x}\text{Sr}_x\text{Co}_{1-y}\text{Fe}_y\text{O}_{3-\delta}$, wherein x and y are independently equal to a value comprised between 0 and 1, extremes included and δ is from stoichiometry.

25 20. Solid oxide fuel cell according to claim 1 wherein the cathode comprises a doped ceria.

21. Solid oxide fuel cell according to claim 1 wherein the electrolyte comprises a doped ceria.

22. Solid oxide fuel cell according to claim 1 wherein the electrolyte membrane is not supporting.

30 23. Method for producing energy comprising the steps of:

- feeding at least one fuel in an anode side of a solid oxide fuel cell comprising an anode comprising a ceramic containing at least one of cobalt

and iron, said ceramic being mixed with doped ceria, a cathode and at least an electrolyte membrane disposed between said anode and said cathode;

- feeding an oxidant in a cathode side of said solid oxide fuel cell; and
- oxidizing said at least one fuel in said solid oxide fuel cell, resulting

5 in production of energy.

24. Method according to claim 23 wherein the at least one fuel is hydrogen.

25. Method according to claim 23 wherein the at least one fuel is an alcohol.

10 26. Method according to claim 23 wherein the at least one fuel is a hydrocarbon in gaseous form.

27. Method according to claim 26 wherein the hydrocarbon is substantially dry.

15 28. Method according to claim 23 wherein the at least one fuel is a hydrocarbon in liquid form.

29. Method according to claim 23 wherein the at least one fuel is substantially dry methane.

30. Method according to claim 23 wherein the fuel is internally reformed in the anode side.